CLAIMS

What is claimed is:

1. A method for inhibiting expression of a hypoxia-inducible gene in a cell in hypoxic conditions or expected to undergo hypoxic conditions, the method comprising introducing a ribonucleic acid (RNA) into the cell in an amount sufficient to inhibit expression of the hypoxia-inducible gene, wherein the RNA comprises a ribonucleotide sequence which corresponds to a coding strand of the hypoxia-inducible gene.

2. The method of claim 1, wherein the hypoxia-inducible gene is HIF-1α.

3. The method of claim 2, wherein the HIF-1α gene comprises a nucleotide sequence of one of SEQ ID NOs: 1 and 3.

4. The method of claim 1, wherein the RNA comprises a double-stranded region comprising a first strand comprising a ribonucleotide sequence that corresponds to a coding strand of the hypoxia-inducible gene and a second strand comprising a ribonucleotide sequence that is complementary to the first strand, and wherein the first strand and the second strand hybridize to each other to form the double-stranded molecule.

5. The method of claim 4, wherein the RNA comprises one strand that forms a double-stranded region by intramolecular self-hybridization that is complementary over at least 19 bases.

6. The method of claim 4, wherein the RNA comprises two separate strands that form a double-stranded region by intermolecular hybridization that is complementary over at least 19 bases.

7. The method of claim 4, wherein the double stranded region is at least 15 basepairs in length.

8. The method of claim 7, wherein the double stranded region is between 15 and 50 basepairs in length.

9. The method of claim 8, wherein the double stranded region is between 19 and 30 basepairs in length.

10. The method of claim 4, wherein a length of the double stranded region is selected from the group consisting of 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, and 30 basepairs.

11. The method of claim 1, wherein the expression of the hypoxia-inducible gene is inhibited by at least 10%.

12. The method of claim 1, wherein the cell is present in an organism, and the RNA is introduced into the organism.

13. The method of claim 1, wherein the cell is present in an organism and the RNA is introduced by extracellular injection into the organism.

14. The method of claim 1, further comprising introducing a vector into the cell, wherein the vector encodes the RNA.

15. A method for inhibiting expression of a hypoxia-inducible gene in a subject, the method comprising:

(a) providing a subject containing a target cell, wherein the target cell comprises the hypoxia-inducible gene and the hypoxia-inducible gene is expressed in the target cell when the target cell is exposed to hypoxic conditions; and

(b) introducing a small interfering RNA (siRNA) into the target cell, wherein the siRNA comprises a nucleic acid sequence corresponding to the hypoxia-inducible gene.

16. The method of claim 15, wherein the subject is an animal.

17. The method of claim 15, wherein the small interfering RNA (siRNA) comprises a double-stranded structure with duplexed ribonucleic acid strands and one of the strands is complementary to a portion of the hypoxia-inducible gene.

18. The method of claim 15 wherein the small interfering RNA (siRNA) is introduced into the subject and outside the target cell.

19. The method of claim 15, wherein the introducing a small interfering RNA (siRNA) into the target cell comprises introducing a vector encoding the small interfering RNA (siRNA) into the target cell.

20. A method for suppressing the growth of a hypoxic cell in a subject, the method comprising contacting the cell with a vector comprising a small interfering RNA (siRNA) molecule under conditions sufficient to allow entry of the vector into the cell, wherein the siRNA molecule comprises a sense region and an antisense region and wherein the antisense region

comprises a nucleic acid sequence complementary to an RNA sequence encoding a hypoxia-inducible gene product and the sense region comprises a nucleic acid sequence complementary to the antisense region.

21. The method of claim 20, wherein the cell is a tumor cell.

22. The method of claim 21, wherein the tumor cell is in a hypoxic region of a tumor.

23. The method of claim 22, wherein the subject is a mammal.

24. The method of claim 20, wherein the vector comprises a liposome.

25. The method of claim 20, wherein the hypoxia-inducible gene is hypoxia inducible factor 1 alpha (HIF-1α).

26. The method of claim 25, wherein the HIF-1α gene comprises a nucleotide sequence of one of SEQ ID NOs: 1 and 3.

27. The method of claim 20, wherein the introducing is via a route of administration selected from the group consisting of intravenous administration, intrasynovial administration, transdermal administration, intramuscular administration, subcutaneous administration, topical administration, rectal administration, intravaginal administration, intratumoral administration, oral administration, buccal administration, nasal administration, parenteral administration, inhalation, and insufflation.

28. A method for suppressing the growth of a hypoxic cell in a subject, the method comprising contacting the cell with a vector encoding a small interfering RNA (siRNA) molecule under conditions sufficient to allow entry of the vector into the cell, wherein the siRNA molecule comprises a sense region and an antisense region and wherein the antisense region comprises a first nucleic acid sequence that is 100% complementary to at least 19 contiguous nucleotides of a hypoxia-inducible gene sequence and the sense region comprises a second nucleic acid sequence that is 100% complementary to the first nucleic acid sequence.

29. The method of claim 28, wherein the cell is a tumor cell.

30. The method of claim 29, wherein the tumor cell is in a hypoxic region of a tumor.

31. The method of claim 28, wherein the subject is a mammal.

32. The method of claim 28, wherein the vector is an adenovirus vector.

33. The method of claim 28, wherein the hypoxia-inducible gene is hypoxia inducible factor 1 alpha (HIF-1α).

34. The method of claim 33, wherein the HIF-1α gene comprises a nucleotide sequence of one of SEQ ID NOs: 1 and 3.

35. The method of claim 28, wherein the introducing is via a route of administration selected from the group consisting of intravenous administration, intrasynovial administration, transdermal administration, intramuscular administration, subcutaneous administration, topical administration, rectal administration, intravaginal administration, intratumoral administration, oral administration, buccal administration, nasal administration, parenteral administration, inhalation, and insufflation.

36. A small interfering RNA (siRNA) molecule that down regulates expression of a hypoxia-inducible factor 1α (HIF-1α) gene by RNA interference.

37. The siRNA molecule of claim 36, wherein the siRNA molecule comprises a sense region and an antisense region and wherein the antisense region comprises a first nucleic acid sequence that is 100% complementary to at least 19 contiguous nucleotides of a hypoxia-inducible factor 1*α* (HIF1-*α*) gene sequence and the sense region comprises a second nucleic acid sequence that is 100% complementary to the first nucleic acid sequence.

38. The siRNA molecule of claim 37, wherein the siRNA molecule is assembled from two nucleic acid fragments, wherein one fragment comprises a sense region and the other fragment comprises an antisense region of the siRNA molecule.

39. The siRNA molecule of claim 38, wherein the sense region and antisense region are covalently connected via a linker molecule.

40. The siRNA molecule of claim 39, wherein the linker molecule is a polynucleotide linker.

41. The siRNA molecule of claim 40, wherein the polynucleotide linker comprises from 5 to 9 nucleotides.

42. The siRNA molecule of claim 39, wherein the linker molecule is a non-nucleotide linker.

43. The siRNA molecule of claim 37, wherein the sense region comprises a contiguous 19-30 nucleotide subsequence of one of SEQ ID NOs. 1 and 3.

44. The siRNA molecule of claim 37, wherein the sense region comprises the sequence 5'-GATGACATGAAAGCACAGA-3' (SEQ ID NO: 7) and the antisense region comprises a 100% reverse-complement of SEQ ID NO: 7.

45. The siRNA molecule of claim 37, wherein at least one of the sense region and the antisense region comprises a 3'-terminal overhang.

46. The siRNA molecule of claim 45, wherein at least one 3'-terminal overhang comprises from 2 to 8 nucleotides.

47. The siRNA molecule of claim 37, wherein the sense region comprises one or more modified pyrimidine nucleotides.

48. The siRNA molecule of claim 37, wherein the sense region comprises a terminal cap moiety at a 5'-end, a 3'-end, or combinations thereof.

49. The siRNA molecule of claim 37, wherein the antisense region comprises one or more modified pyrimidine nucleotides.

50. The siRNA molecule of claim 37, wherein the antisense region comprises a phosphorothioate internucleotide linkage at a 3' end of the antisense region.

51. The siRNA molecule of claim 37, wherein the antisense region comprises 1-5 phosphorothioate internucleotide linkages at a 5' end of the antisense region.

52. The siRNA molecule of claim 45, wherein the 3'-terminal nucleotide overhang comprises one or more chemically modified nucleotides.

53. The siRNA molecule of claim 52, wherein the 3'-terminal nucleotide overhang comprises ribonucleotides that are chemically modified at a nucleic acid sugar, base, or backbone position.

54. The siRNA molecule of claim 45, wherein the 3'-terminal

nucleotide overhang comprises one or more universal base ribonucleotides.

55. The siRNA molecule of claim 45, wherein the 3'-terminal nucleotide overhang comprises one or more acyclic nucleotides.

56. The siRNA molecule of claim 45, in a pharmaceutically acceptable carrier.

57. An expression vector comprising a nucleic acid sequence encoding at least one siRNA molecule of claim 36.

58. A mammalian cell comprising an expression vector of claim 57.

59. The mammalian cell of claim 58, wherein the mammalian cell is a human cell.

60. The expression vector of claim 57, wherein the siRNA molecule comprises a sense region and an antisense region and wherein the antisense region comprises a first nucleic acid sequence that is 100% complementary to at least 19 contiguous nucleotides of a hypoxia-inducible factor 1α (HIF-1α) gene sequence and the sense region comprises a second nucleic acid sequence that is 100% complementary to the first nucleic acid sequence.

61. The expression vector of claim 57, wherein the siRNA molecule comprises two distinct strands having complementary sense and antisense regions.

62. The expression vector of claim 57, wherein the siRNA molecule comprises a single strand having complementary sense and antisense regions.

63. An adenovirus vector comprising the small interfering RNA (siRNA) molecule of claim 36.